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Conservation of Brick Towers in Prah Ko  
ANGKOR  
CAMBODIA  
(February to April 1994)

Critical report on the implementation of the Prah Ko project  
*to*  
The Angkor Foundation  
*by*  
Christophe POTTIER, Architect (EFEO)  
April 1994

## **Critical report on the implementation of the Prah Ko project (February to April 1994)**

The purpose of this report is to analyze the site implementation of the Prah Ko Project. These following lines rise or underline different matters and aspects of the starting of Prah Ko Project, some of them definitely negative, other more positive, but all of them in the concern for an improvement of the next phase of the Prah Ko project.

### **Cooperation with Cambodian counterpart**

- In spite of the present state of the Conservation d'Angkor, its extremely reduce means and personnel, it's obvious than the Prah Ko project filled all its main targets with the Conservation d'Angkor. The team get a good support by M. Tuy Koeun, a very comprehensive representative of the Ministry of Culture replacing M. Ourn Vong in study tour to Japan. The Conservation d'Angkor showed strong support by providing cars, storeroom for equipment, and more valuable, part of their staff. As far as I know, we should just notice a unique case of a one personnel of the Conservation d'Angkor who showed strong reluctance to work with the team, for some reason surely not link with the project. The Conservation d'Angkor involved itself in the project and some visits on site or some comments and questions I had asked showed its concern for it. On an other way, it is certain that the Conservation d'Angkor was sensible to the various speeches made by the Prah Ko project experts and to the heavy training aspect for the workers involved. For the first implementation of the Prah Ko project, I just really don't know what could have been done more on both sides. Human relations have been establish and despite some accepted ideas, the Prah Ko project members wined some Conservation d'Angkor's trust. Meanwhile, it should be checked for next year program than similar "accommodation" could be provided by the Conservation d'Angkor as it is under process of re-organization (store room, cars...). Without to become propaganda, site visits could be developed.

- Less positive is the cooperation with the Université des Beaux-Arts. It's obvious that the Université des Beaux-Arts is actually in a complex situation and very good reasons and Government choices restrain to send students on field mission. Two students inscribed in Faculty of Archaeology from Université des Beaux-Arts joined the Prah Ko project partially,

resulting more from a personal initiative than an official agreement. The training aspect of the Prah Ko project should be obviously more efficient if an agreement could be made for the next phase. We should also note that there is reduce archaeological interest in the kind of work undertake by the Prah Ko project and it could be more accurate to involve students of architecture department of Université des Beaux-Arts who have special interest for restoration. It could have been a valuable interest for the Prah Ko project as the architectural survey was not existing. I underline the very strong architectural aspect of the works planned in the second phase. The need for training is high in Angkor and it should be necessary not to do "training for training" but to provide skills to accurate person for better efficiency.

- Despite the following subject is out of the mission I was in charge of, I would mention the care needed to clearly explain to the representatives of the Royal Gouvernement of Cambodia the project and its purpose, and to get any official authorization needed before any field implementation. Obviously, it is a major point for a good implementation of any project in Angkor. Clear information and official agreement are the basic needs to ensure a successful work. A task and a vision without an authorization are but a dream. In this spirit, the misunderstanding shown by H.E. Vann Molyvann about the goals of the project is a very serious matter to avoid, especially because the fact is representative of the lack of right information about the hole project. Laughable "articles" in local newspaper could have cause as much trouble... Real and deep information as reasonable publicity of the project should be reach in the next phase of Prah Ko project.

- Cooperation with other restoration teams, despite it was not a main target of the Prah Ko project, can be analyze as successful. Most of the team members paid visits spontaneously to other works in progress, had rich discussions and some friendly helped them on special occasion with advice and tests. Although this attitude was mostly the result of the open mind of the members, it should be encouraged in the next phase of the Prah Ko project.

#### **Matters of restoration:**

##### **- Stucco**

##### *Evaluation of the 1992 test by Rodolfo Lujan*

From site observations and discussions with the author of this work, Rodolfo Lujan, and with Pierre Pichard, it has been commonly agreed that this work could be a useful reference for the Prah Ko project and the sane

methodology should be kept. Meanwhile, some "aesthetic" remarks were raised related to the high visibility of repointing at the edges of the remaining parts. In fact, as the smallest part of an iceberg, it is the most visible one. It was agreed to solve this detail by using pigmented mortar or application of patina. What was a detail on this stage of preliminary work should not be neglected on the Prah Ko project.

*Work realized by Prah Ko project*

Technical evaluation of the work done is the responsibility of the expert in charge of it and my appreciation had special concern for the visual aspect of the consolidation. Meanwhile, it's evident that, technically, consolidation realized corresponds well to the mission's objectives. But it is important to mention the difficulties of implementation than the experts had to face with (delay for the arrival of equipment, products, delay for realization of base documentation, delay for the scaffolding, extra workhours...). It didn't do real damage to the final result but it has stop it from being completely fulfilled.

After completion of the work, seenable aspect of this delays is obvious with the partial lack of patina and the unfinished cleaning of lime flow on brick walls of the NE tower for instance. These are fortunately un-permanent matters and "details" but they are, in a sense, "harmful" as the Prah Ko project doesn't have a permanent presence on site. Between two phases, the temple and the sate in which it has been let are the main advocate of the project.

Various delays bother regular progress of the work : erection of scaffolding may be a very significant and caricatural example (as delays in the arrival of products...). The first scaffolding (SW tower, made in bamboo, wood and ropes) erection began on 2/02, completed on 16/02, nearly a month after the arrival of the experts...and without to be totally secure. As the second (on SE tower, built with metal tubes from the Conservation d'Angkor) began on 22/02 and finished on 16/3, the third (CE tower) on 17/3 to 25/3, the third had to wait the SW one to be dismantled on 22/3 before to be erected on the NE tower... a week before the end of the Prah Ko project. Of course, the work done on the first tower went slower to train workers and to define the precise methodology of the intervention. But the various delays have been a serious handicap for the activities (people working on top of each other, obliged quickness of the work for the last towers...). So it seems obvious that the equipment and materials (and documentation) should be better coordinate for the next phase and planning and means should be more carefully planned. The success of the 1994 intervention on stucco should not

forget than it is caused by the deep (and extra) involvement of both the experts and the workers.

For technical reason (high temperature) and delays in the availability of the chemicals, it has not been possible to realize planned Ethyl silicate consolidation on damaged stuccos parts. So this careful and long work has been delay to the next phase of the Prah Ko project.

#### - **bricks**

In some parts of the brick work, the difficulties were very similar to the stucco's ones. So micropointing and filling of cavities was done mainly on the longest available areas : bases of towers and the complete SW tower. On the other parts of the other towers, the brick work was limited by the remaining time and focused on most sensible areas. As this work was not planned to end this year (it should continue on the 2nd phase), it is irrelevant to evaluate any rate of completion for this year. We shall just have to plan the continuity of these interventions next year.

A long but normal step of preliminary tests was realize to get accurate tones and color and convenient application of plaster. On an aesthetical aspect, the result of brick repointing is unobtrusive for observers and reaches the difficult constraint.

In order to reduce water infiltration, top surfaces of superstructures were improve to speed up evacuation of rainwater. Paving terra-cotta (30x30cm) and small brick works were placed on top of the towers to avoid rain (and bats) penetration inside the cella without stopping air circulation. These works are invisible from the platform. As this kind of work is planned to be increase on next phase, it is necessary to mention that an important problem will be the availability of new bricks to fix chosen missing parts to be rebuilt (cornices, mouldings of the bases ...). The availability problem should absolutely be solve before any further implementation (the documentation problem too...). It seems than the previous restorations (which, after all, done a little bit the same with cement mortar) used already all the fallen and loosen bricks.

Desalinization test has been conducted (the last day...).

#### - **sandstone**

Sandstone emergency consolidation was less sensible to delays for scaffolding (sandstone is located in lower parts), but as preoccupied with the arrival of material. Unfortunately, the late final completion of activities in

the Prah Ko project avoided useful deeper involvement of the expert and his reduce team in other sites (especially at the Conservation d'Angkor).

Sandstone micropointing used the same process than the brick with preliminary tests to obtain satisfactory tones. The target of emergency consolidation is completed and a further involvement could be necessary to solve consolidation of altered parts as lintels or columns, high relieves... and to reinforce few structural elements (door frame of SE tower, W side, false door and lintel of CW tower, W side..).

#### **- cleaning & vegetation**

The implementation of Prah Ko project was offering a precious opportunity to realize various "regular" or common works on the towers of Prah Ko. So cleaning of the terrace, cellae and superstructure was completed.

Parasite vegetation has been manually removed or eradicated by injection or spray of Arsenal (Imazapir) solution. On the beginning of march, vegetation that was let as efficiency indicators showed clear signs of lethal sickness. Biocide solution was also applied on the base of the towers. It is regrettable than workers didn't get all protection since the beginning of this work.

The cellae have been cleared and clean from the mess that was filling them (a strange mixture of statues, antefix and pedestal fragments in sandstone, slides and powder of fallen stucco, parts of bricks, all glued in a dense and smelly guano sauce). Fragments were inventoried and identified on this occasion.

#### **- other works**

On the last few days, a test has been applied on the base of the SW tower : to avoid heavy infiltration in the brick base of the tower, a lime mortar mixed with brick fragments was applied between sandstone base and damaged brick. Showing a very high capacity of absorption, the internal parts of the tower seem to need further injection to consolidate what appear as a "gruyere". Less available during the last period of the work, I didn't follow this intervention, so it is not tactful for me to appreciate it. The purpose of this test (easily reversible) is certainly based on indubitable concern for water infiltration and it will efficiently improve the conditions of hygrometry in the structure. However, it is obvious than this intervention is one of the less un-visible one. The nearly white plaster is strongly exposed and doesn't reach the general discretion of the other interventions. After all these centuries of infiltration, raining season after raining season, it can

appear surprising to do this work which should be replaced during the next phase of the Prah Ko project by a more "architectural" and more efficient solution.

Through the comments I had the opportunity to give during field surveys, I mentioned few times the necessity to remove, at least partially, the ugly pointing of cement carelessly applied by the Conservation d'Angkor staff in 1993 on some base of stone reliefs to prevent further theft. It is surely a "detail" and it was not directly related to the Prah Ko project. Although some have been removed on the beginning of the mission (it is definitely not an easy work to do), the final hurry avoids to spend time on this matter and some are still existing nearby sensible Prah Ko project intervention. As in Angkor and elsewhere, "cement has no owner", a harmful link is easy to do, especially when few meters from them, a very similar gray lime mortar has been used by the Prah Ko project for emergency consolidation on a cornice in good way to collapse...

### **Training**

The training aspect of the Prah Ko project has been well developed and implemented. This training concerned workers of the Conservation d'Angkor, local workers from nearby villages and two students of the archaeological department of Université des Beaux-Arts. Some workers of the Conservation d'Angkor were already involved in the 1992 mission by Rodolfo Lujan. Through the various discussions with the Prah Ko project experts and seeing the results of the works, it seems that majority of the workers involved themselves and learned the technique efficiently. A careful monitoring is still needed to guide and control their intervention and to prevent damageable work. But a qualified team has been built and it could and should be employed in the next phases. Before to undertake similar works elsewhere, the management should be developed and some rather special foremen should be trained on the next mission. They could help efficiently on organization matters, anyway more efficiently than the translator engaged in 1994 does. As mentioned above, the impossibility to involve officially Université des Beaux-Arts students on the 1994 Prah Ko project is a pity and this should be tried again next year, maybe with students of architecture. If not, local personnel (of the Conservation d'Angkor or not) could be involved, in spite of the risk that they could leave this work after. Any initiative of Prah Ko project to develop foreign language knowledge for them could be welcome (there is in Siemreap both English and French teaching centers).



## **Documentation**

Another subject, where improvement is compulsory, is the realization and the availability of documentation bases. Preliminary documentation was nearly non-existent on the start of this work, and the efforts of Laszlo Nagy to provide base elevations are significant. But as this aspect has been neglected in the planning, it was materially impossible to reach the goals. We should remember that realization of a classical and precise survey (1/50° elevations and sections) can take much more than a month with an efficient team of draftsmen, all equipment and scaffoldings... Nothing of that was available at the Prah Ko project. As preliminary photogrammetry was a failure, and the huge works realized by Laszlo Nagy are still uncompleted, it will be crucial to find an efficient solution for the next phase and before the start of architectural work.

Photographic survey has been more satisfactory although it has been available quite late.

Various requests for the Conservation d'Angkor to come on site to print some new inscriptions have been fruitless. We can hope to see this done before next year.

## **General summary of the implementation and Recommendations for further works.**

- Administrative : to develop information about the project, strict application of the existing administrative procedures and deep local involvement with local authorities to clarify security and organization matters.
- Materials and equipment : despite urgencies of the consolidation work and the limited time of the Prah Ko project, to avoid implementation before any materials and equipment needed are already available on place, to prevent final rush and uncompleted works.
- Accommodation and transportation : to consider autonomous material implementation without reducing collaboration with the Conservation d'Angkor (the Conservation d'Angkor should be in a close future increasingly busy and could not be as available to provide material facilities).
- Continuous self challenge : facing various imponderables (security, delays, discoveries...), the team showed in 1994 a good capacity to call itself into question. This capacity should be maintained in further phase to respond efficiently to any shifting situation.

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26/04/94